SCIENCE INSTRUMENT AIRWORTHINESS AND CERTIFICATION PROCEDURES

Section 600:
Operations and Maintenance

600 Operational Procedures

600.1 Introduction

One reason for the STC process is to comply with FAR Part 121 requirements. This will allow operation per United Airlines processes to significantly increase mission flexibility. Compliance with these requirements will be assisted and supported by the United organization.

Two aspects that are new to the science community are 'Configuration Control' and 'Continued Airworthiness'. While these are not all of the new conditions they are essential to mission reliability and safety.

Configuration control is processes. Standard laboratory practices already call for maintaining conditions in the science instrument for scientific reliability. Configuration control processes for safety will use the same methods as those for science but will test, or inspect for different aspects of the science instrument. For example, the maintenance manual for a particular science instrument will be written by the SI team, with guidance from United as discussed in the Section 600.3.

The maintenance manual will include aspects of the SI that affect the airworthiness of that science instrument which might include inspections of the pressure boundary o-ring, external electronics wiring, or flange attachment hardware.

600.1.1 For UAL, operations, maintenance, and continued airworthiness are not separable into neat categories. Most items in one area, operations for example, will affect the maintenance and continued airworthiness of that SI. Therefore maintenance manuals must be written specific to each instrument. There will of course be common areas such as leak checking or wiring inspections and these may be simply added to an SI maintenance documentation from a canned version that applies to all instruments.

Other items, such as pressure coupler or window inspections, will depend on the specifics of the science instrument and must be documented in sufficient detail to allow straightforward inspections to be done.

600.1.2 Operational Continued Airworthiness and Maintenance. Continued Airworthiness as applies to Science Instruments is a system whereby the qualifications derived in the STC process are continued through out the life of the Instrument. United's maintenance system supports this effort. Each Science Instrument will have an Airworthiness Tag attached to it. This is placed on assemblies and subassemblies to show personnel and other concerned parties that it can be used on an aircraft. The Instruments will have a set of requirements to acquire this

tag. This will include receiving, build-up and operating inspections. It is the intent of any certification process to have these inspections and other supporting requirements be concurrent with existing processes. Most processes used to verify Airworthiness requirements exceed or parallel those required for mission support.

Example: A receiving inspection and pressure check are already accomplished during normal mission preparations.

600.2 Instrument Logbooks

During science instrument operations in a laboratory, or at a telescope, the use of a daily logbook is standard good practice. For this reason, it should be quite simple to implement a similar standard at the SSMOC for a facility SI or in the home institutions of each PI instrument. There will be different information recorded in the instrument logbook verses the science logbook, but the process will be quite similar. The logbook will be a hardbound notebook of the type used in a scientific lab with ruled pages that cannot be removed from the book (i.e. not a loose leaf binder as will be used for the certification logbook discussed in Section 200).

In this way changes or improvements made on a science instrument will be easily tracked by keeping them documented in the Instrument Logbook (IL). The instrument logbook should stay with a specific SI at all times including on the ground (in the SSMOC) and during flight.

Logbook Contents (suggested)

1. Date, Time and Location
2. Persons in attendance
3. Action taken (some examples are listed here)
   - Cool down cycle
   - Pressure cycle
   - Inspections etc.
4. Reason for action
5. Parts list if applicable
6. Any Illustration or diagram needed.
7. Result

600.3 Maintenance Manuals

Maintenance Tasks are processes that are done to ensure that a specific science instrument is ready for flight (i.e. airworthy). The receiving, build-up, testing, calibration, inspection, installation and possibly other tasks fall within this definition.

Some Tasks will be required for continued airworthiness per the STC process while others support mission readiness and availability. The following is a set of guidelines to develop tasks and their subsequent documents.

One aspect of operations that is new is an 'Airworthiness Tag' physically attached to the instrument. This tag indicates airworthiness to United personnel and regulatory agencies.

In order to support the Airworthiness Tag, specific documentation and processes must exist. The format of this documentation should comply with Air Transport Association (ATA) format. Please refer United Document F-2566 for manual development guidelines.

Most of the tasks are already part of instrument operations past and present. The documenting will aide in accomplishment and is essential to the Facility Instruments. As explained in F-2566 a simple and common format will be a great help in all aspects of a successful mission. Some aspects of SI maintenance will be so similar that they can be documented just once for all subsequent instruments. These could include leak check documents and cool down procedures and there may be others. In these cases one document can be written and approved for all instruments and simply included in an SI maintenance manual.

This section has a list of operations that could be performed at the SSMOC, which will be part of the science instrument maintenance manual. In this case, maintenance means anything that must be done to ensure that a specific science instrument is ready for flight (i.e. airworthy). This is a partial list. Each SI team will generate a list such as this, which is specific to that particular science instrument. At certain steps in the following list there may be procedures written, inspections, tests or other airworthiness checks. Those are annotated with 'MM' as these will necessarily require some documentation in the SI Maintenance Manual. Typical science check points have not been included in this list because they will not be required to complete a maintenance manual, but are understood to be mixed in with the following steps.

1. Arrive at the SSMOC
    - Unpack
2. Configuration and Inspection (MM)
    - Cryostat
    - Electronics
    - Counterweight
    - PI Rack
3. SI Pump Down (MM)
    - Leak Check
4. Begin Ln2 Cool Down (MM)
    - Begin Lhe Cool Down
    - SI Testing
5. Transfer to the TAAS (MM)
    - Weight and Balance
    - CG

Cabling
6. Remove from the TAAS (MM)
7. Transport to Aircraft MM)
8. Install (MM)
   COAX Neck
   Relief Devices
   Cabling
   Prepare for take off
9. In Flight Operations (MM)
   Landing/Taxi
10. Remove from TA (MM)

600.4 Conclusions

Operations, maintenance and continued airworthiness are quite connected, and so it is difficult to list here all the requirements for maintenance (which includes operations and continued airworthiness) at this time. The most important aspects of an SI will be identified during the STC process. Some may require further documentation during mission operations once an SI arrives at the SSMOC. United Airlines and USRA will aid SI teams in all areas related to these maintenance manuals, and continued airworthiness.